UNIVERSITY OF CALIFORNIA.

AGRICULTURAL EXPERIMENT STATION.

BULLETIN NO. 24.

[In order to render the results of investigations and experiments conducted by the Agricultural Department of the University of California more quickly and more generally available than has heretofore been done through the annual or biennial reports, it is proposed to embody hereafter, in the form of "Bulletins," to be issued as often as may seem desirable, reports of results, as well as such other discussions, information or answers to questions as may be of general interest. It is intended to make these bulletins, as a rule, short enough for insertion in the daily or weekly papers of the State, and proof-slips of the same will be regularly mailed to papers applying therefor. The substance of these bulletins are ultimately be embodied in a more complete and connected form, in the annual reports of the College of Agriculture.]

Examinations of Grape-growing Soils.

No. 727.—*Sand-hill soil*, from a tract near "Fancher Creek Nursery," about 7 miles southeast from Fresno city. Sent by Dr. Gustav Eisen, of Fresno. This is a representative sample of the soil of the higher "sand-hill" ridges which traverse the Fresno country irregularly, mostly in a northeast and southwest direction. They are but slightly elevated above the general level of the country, and frequently without any obvious relation to the present drainage; their sandy soil passes by gradations into the "brown adobe" bordering the foothill streams, or into the reddish, light loam of the country inland. In some cases their material was originally so loose as to be blown about by the wind. Their vegetation was the usual one of dry lands in the San Joaquin valley, viz.: In spring, more or less of the bright flora of gilias and dwarf sunflowers (*Baeria chrysostoma*), and during the dry season the drouth-resisting turkey-weed (*Eremocarpus setigerus*) and the blue camphor-weed (*Trichostema lanceolatum*), with a few others. Since irrigation has become general, and the land has filled up with water, the deep, pervious soil of the sand-hills has followed the general example of the plain in growing up into tall weeds, such as the pig-weed (*Erigeron Canadense*), cockle-bur (*Xanthium strumarium* and *spinosum*), sunflower (*Helianthus Californicus*), and others. This rank growth has encouraged the settlement of sand-hill tracts, previously supposed to be too poor for profitable cultivation, until at present large areas of such soil are occupied by flourishing colonies, *e. g.*, the Scandinavian. The question now arises, how durable the productiveness of this soil is likely to be.

The sample sent by Dr. Eisen is very sandy and unpromising-looking—probably the extreme of its kind. It was taken to the depth of 12 inches. The whole of it passes through the sieve of 1-50 inch meshes—a fine, grayish-yellow sand, with black particles (which are mainly hornblende), while the white portion is a mixture of angular quartz, feldspar, and glassy particles of pumice-like aspect under the microscope—a material of which considerable beds are found on King's river where it issues from its canyon in the Sierra. On moistening it scarcely becomes adhesive.

The chemical analysis resulted as follows:

	FRESNO SAND-HILL SOIL. CALIFORNIA.	HOMOCHITTO BOTTOM SOIL. MISSISSIPPI.
Insoluble Residue.....86.58)	90.11	91.97
Soluble Silica..... 3.53)		
Potash.....	.19	.15
Soda.....	.38	.04
Lime.....	.99	.12
Magnesia.....	.78	.21
Br. Oxide of Manganese.....	.06	.28
Peroxide of Iron.....	3.20	1.18
Alumina.....	3.13	3.27
Phosphoric Acid.....	.02	0.08
Sulphuric Acid.....	.04	0.05
Water and Organic Matter.....	1.53	2.70
Total.....	100.43	100.05
Humus.....	.43	
Available Inorganic.....	.50	
Hygroscop Moisture.....	1.21	4.05
Absorbed at.....12° C		8° C

It cannot be expected that in a soil containing 90 per cent of inert sand, large percentages of plant food should be found; and if the figures in the above table referred to a clay soil, or to a sandy soil of little depth, little could be said for it. But when such sandy material is from 6 to 10 feet and more in depth, and roots can penetrate it as fast as they can grow, the case assumes a different aspect, since in that case the plant can and does utilize as a source of nourishment not (as is the case in close soils), 12 to 20 inches, but from 3 to 8 feet, as is shown by inspection. To obtain the proper comparison with a clay soil, therefore, we should multiply the figures in the table by 3 or 4, which will give respectable percentages of all, and a very high one especially of lime. By way of illustration, the analysis of a soil somewhat similarly circumstanced in the State of Mississippi, and noted for its high production of cotton for many years, is placed alongside. The sand-hill soil is eminently a calcareous one, and as such its plant food is in a highly available condition. At the same time, the high figures for soda and sulphuric acid show the presence of some alkali, viz.: Glauber's salt, which is, with the lime, perceptible in the well waters of the region. Here also, however, phosphoric acid is relatively the lowest in supply, and will be first needed when fertilizers are called for by the falling-off of production. At the same

time, the increase of the humus or vegetable matter of the soil should be favored in every possible way, since in so pervious a soil with so much lime, the supply will, under tillage, rapidly decrease in so hot a climate.

One point needs mention in this connection, viz.: the rapid rise of the bottom-water level that has lately occurred from the multiplication of irrigation ditches without any corresponding arrangements for drainage. Of course roots cannot penetrate beyond the water level, and will not ordinarily exercise their functions even very close to it. When, therefore, the water is found in the bottom of fence-post holes, as is now the case in some fields of such soil, the available depth of soil is correspondingly reduced, just as though the bedrock were found at the same depth. When this happens in the case of such deep-feeding plants as the vine, it is simply ruinous, and if it does not result in the death of the vine, must greatly reduce both the quantity and quality of its product. This is a growing evil which even now sorely afflicts some vineyards, whose owners have never ceased to imagine that the one thing needful for success in that region is plenty of water, and that there cannot be too much of a good thing.

No. 799. *Valley soil*, taken on a creek heading near Nun's canyon, on Oakville and Glen Ellen road, Napa county.* The valley is a narrow one, of a briskly flowing stream on the Napa side of the divide. It is not under cultivation near the point where the sample was taken, but the spot is remarkable for the luxuriant growth of wild grape vines, which cover not only the bottom but run up high on the hillsides. The opportunity seemed a good one for ascertaining just what kind of soil the California wild vine delights in, thus giving a clue to the proper selection of soils on which it is to form the stocks. There is apparently little change in the soil for twelve or eighteen inches; it is of a gray tint, stiffish and bakes very hard when dry, untilled; a light adobe or clay loam. For want of tools for digging, the soil was taken to the depth of eight inches only. It contains no coarse material save a fragment of slate here and there. Its analysis resulted as follows:

VALLEY SOIL, SONOMA MOUNTAINS.

Insoluble Matter	63.55	69.09
Soluble Silica	5.54	
Potash		1.66
Soda		.22
Lime		.60
Magnesia		1.94
Br. Oxide of Manganese		.11
Peroxide of Iron		4.51
Alumina		13.71
Phosphoric Acid		.17
Sulphuric Acid		.07
Water and Organic Matter		7.68
Total		99.55
Humus		2.16
Available Inorganic		.49
Hygroscop. Moisture		7.78
Absorbed at	15° C	

The analysis shows good cause for the preference of the vine for this soil, which is an unusually rich one in all the elements of plant food. Its potash percentage is the highest thus far observed in California, outside of alkali lands. Its supply of lime is not unusually large, but still abundant: its phosphoric acid percentage is among the highest thus far found in the State, as is, outside of Marsh soils, that of humus. In fact, any plant whatsoever might be well pleased with such a soil: and the facts show that the native vine can be a rank feeder when opportunity is offered. These vines seemed to be young and had little fruit set; but whether the latter point was an accident of the season, or whether the soil is too rich for full bearing, requires farther observation to determine. If the latter be true, the remedy in such cases would lie in the use of lime around the vines.

*On the occasion of a tour of observation, made under the auspices of the Viticultural Commission, Oct., 1884.

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